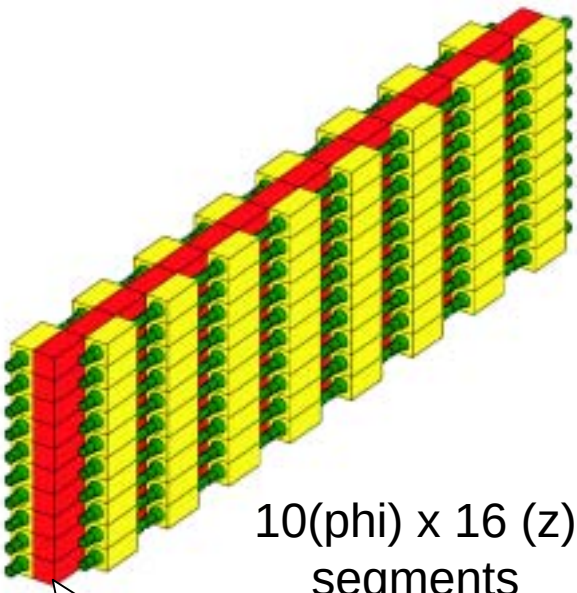
Safety of Aerogel Upgrade

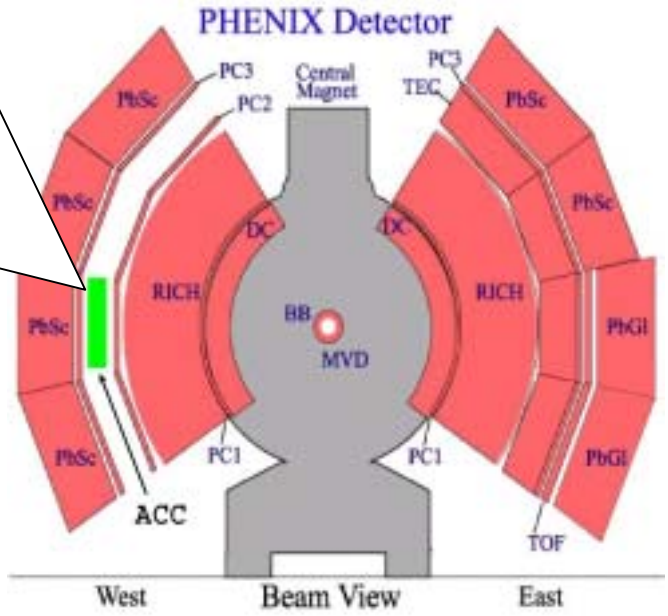
Contents:

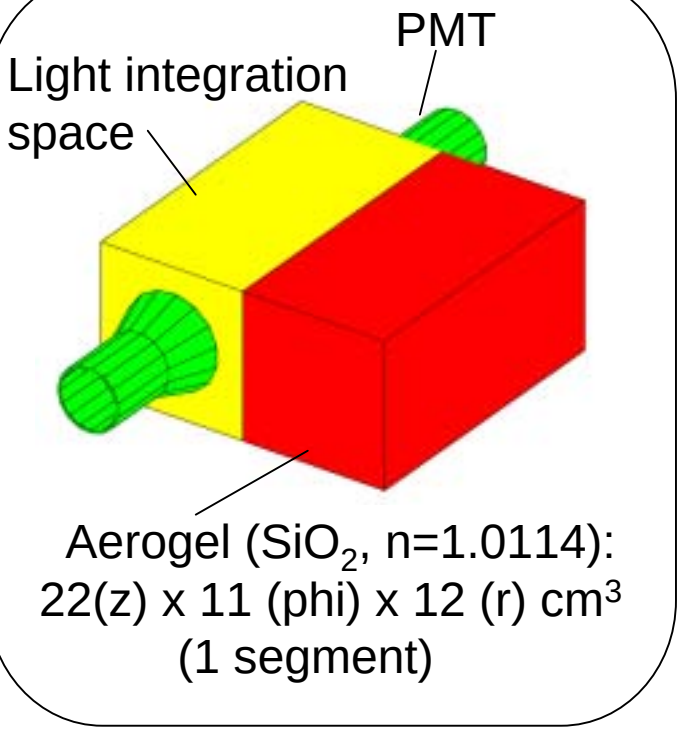
Phenix High-pt Upgrade Team

[0] Overview of Aerogel Counter



10(phi) x 16 (z) segments





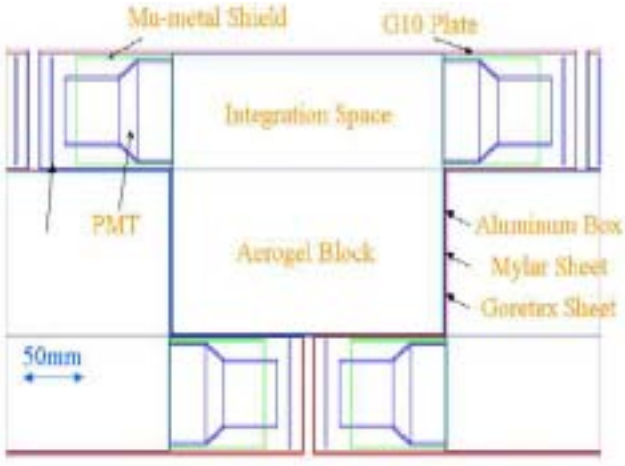
- Hydrophobic Silica Aerogel (90% SiO_2)

- Install in the Phenix west arm (W1 sector), btw. PC2 & PC3.

[I] Material (Material inside Al-box)

Material	Where to use
Al	Box, Lid
Black Paper	Light tighten'er [Note: Fully sandwiched by Al-lid and FR-4]
FR-4	(1)Lid strengthen'er, (2)PMT base
MC901-Nylon	(1)PMT mechanical holder, (2)Spacer btw PMT & mu-metal → See "Data Sheet 3"
Mylar	Inner box
PTFE(*1) (Teflon™)	Reflector (Gore-Tex™) → See "Data Sheet 2"
Silica aerogel	Aerogel → See "Data Sheet 1"
Metal, SiO_2	PMT
Mu-metal	B-shield

(*1) PTFE = polytetrafluoroethylene



All the parts are under: (I) Enclosed environment, and (II) N_2 gas flow

[I] Material (Connector, Cable)

Item	Ever used in Phenix ?	Fire Rate	Electrical
01) Connector (HV)	Used in EMCal (but ours are 3-pin)	UL94V-0	5 kV
02) Connector (Signal, at Preamp)	New	UL94V-0	300 V
03) Connector (Signal, at Box)	Used in EMCal	UL94V-0	3 kV
04) Connector (LED)	New	UL94V-0	600 V
05) Cable (HV)	SL-v2YC$_E$H (KERPEN) → **See "Data Sheet 4"**	IEC60332, IEC60332-3-24,catC	-
06) Cable (Signal, PMT to Preamp)	RG174/U (Coleman) → **See "Data Sheet 5"**	UL VW-1 (*1)	-
07) Cable (Signal, Preamp to FEE)	UL2833 (Hitachi) → **See "Data Sheet 6"**	UL VW-1 (*1)	-
08) Cable (LED)	1872A LAN cable Category-5E (Belden) → **See "Data Sheet 7"**	CMR, UL 1666 Riser, UL-E108998	-
09) Cable (LV for Preamp)	M39118 (CDT) → **See "Data Sheet 8"**	UL1581, PLTC/ITC/CM	-

(*1) VW1 == "vertical wire" class 1 (most strict)
→http://ulstandardsinfonet.ul.com/

All the parts are
(I) Fire-Rate-Acquired, or/and
(II) Previously CAD-safety approved for use in Phenix

[I] Material (Silica Aerogel)

--- Safety issue associated with assembly in Bldg. 510. ---

- It is Silica Aerogel (90% SiO_2)
- Aerogel can be micro dust when fully broken.
  - Fragile, because n=1.0114 (density =0.04 [g/cm^3])
- Assembling of Aerogel at 510-Highbay

  Just in case of crushing into small pieces,

  (1)Person: Better with Mask, Gloves, After-Washing-of-Hands

  (2)Trash-can: Better to have Enclosed-can for broken-Aerogel

From MSDS (For more info, see “data sheet section [1]”)

【 Protective measures, storage and handling 】

＊ in case of crushed pieces or powder

・Technical protective:

When handling larger quantities without extraction plant, breathing and eye protection required

・Personal protective equipment:

Avoid inhalation of dust

【 Information of toxicity 】

・Acute oral toxicity	:lethal dose ＞ 2,000 mg/kg	(tested in mice)
・Skin irritation	:non-irritant	(tested on rabbits)
・Eye irritation	:non-irritant	(tested on rabbits)

[II] HV tolerances test

Note: Operational voltage of PMT is 1.5kV

1. Bleeder (PMT base)

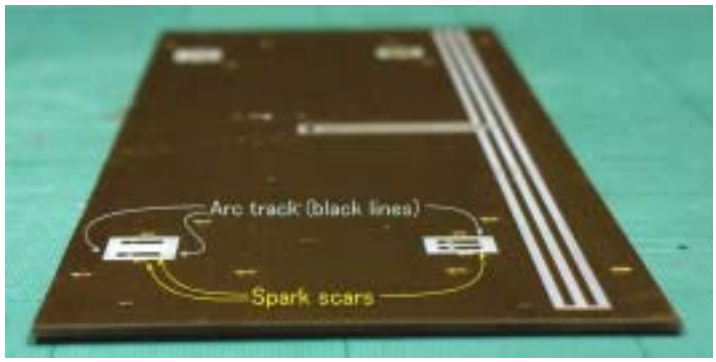
Material: FR-4-97.
Volume resistance rate: > 10^6 M ohm - cm.
Surface resistance: > 10^4 M ohm.
Dielectric breakdown voltage: > 40 kV.
Nonflammable rate: UL 94V-0.
Moisture absorption rate: < 0.35 %
Time: 12 hours (Long-term test of a bleeder)
Temperature: Ave. 29.1 deg.C, (27.1 C ~ 30.5 C)
Humidity: Ave. 54.5 % (52 % ~ 63 %)
High voltage module: HSR-12N (Matsusada Precision Inc.).
Supply voltage: 4,500 - 4,690 V (= 2 times + >1000 V) (increasing slowly).
Idling current: about 0.45 mA.

Test result:

No spark and no smoke

2. Lid of the box

Material: R-1705 in FR-4.
Nonflammable rate: UL 94V-0.
Moisture absorption rate: < 0.25 %.



Test Results:

Stands up to >4kV (1st)

Tested in various places. (V_dielectric_breakdown (Tested several times, 1st→2nd→ 3rd))

<Place-1> P. C. board of a bleeder (No part). (btw GND & HV terminals).
9.5 → 8.7 → 8.9 kV

<Place-2> Signal area on PC board (a lid of the box)(btw. 2 terminals in a connector)
5.8 → 3.9 → 3.9 kV

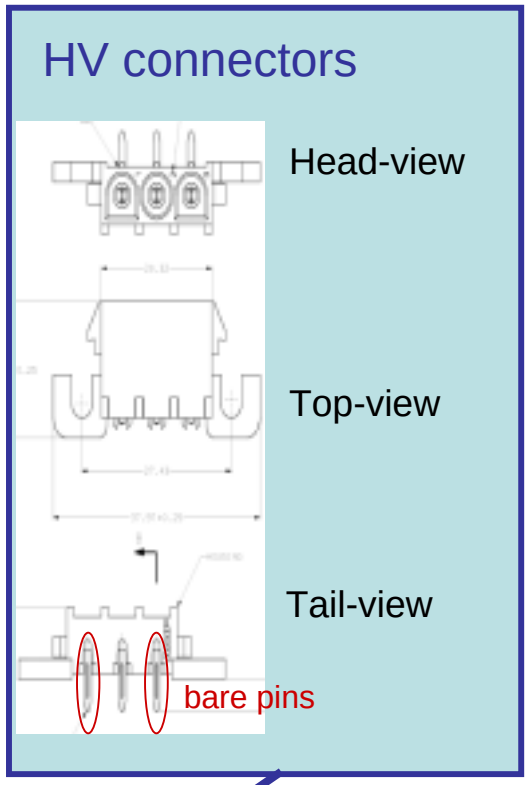
<Place-3> High voltage area on PC board (a lid of the box) (btw. 1 terminal of connector & GND)
4.9 → 5.5 → 4.2 kV

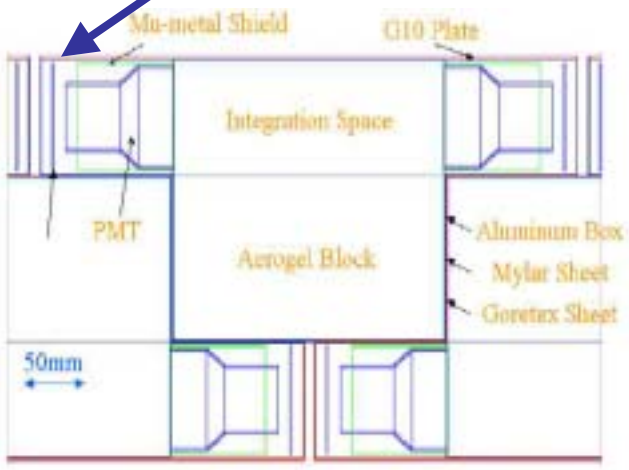
<Place-4> Connector "770994-1 (Right-angle 2-pin header)".
5.8 → 6.1 → 6.0 kV

[II] Electrical safety concern (HV)

HV connector on the lid of box

- Dielectric withstanding voltage: 5kV per gap.
- Moreover, among 3 pins use only 1st and 3rd pin.
- And the Exposed pins are potted with RTV-162.

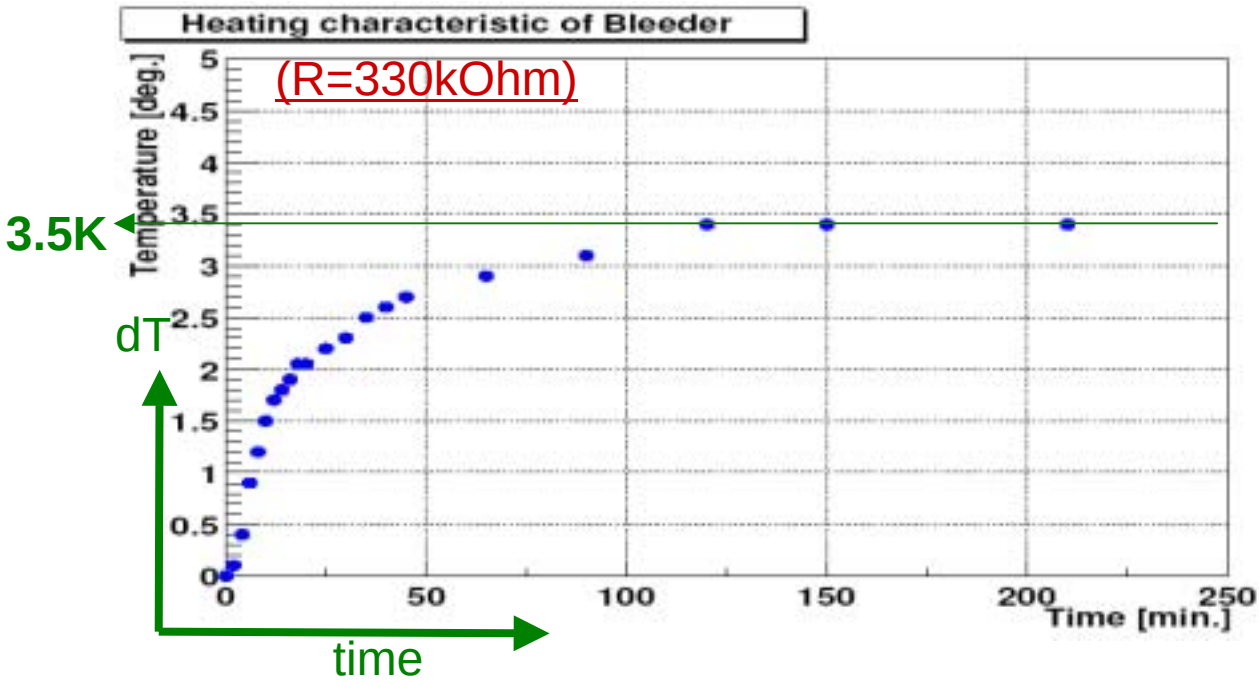




[III] Heat source

(1) Bench test (PMT in Al-Box) shows
only 3.5K(@0.68W/PMT) rise
even without air flow

(2) Moreover, in real,
R = 680kOhm ← 330kOhm
Power = 0.34W(Half)/PMT ← 0.68W/PMT



Therefore, No need of cooling

[IV] Gas

- Nitrogen flow
  - For Purging (~800 liters per hour)
    - of any outgas from chemicals inside the Al-box
  - (As already discussed,) not the issue for cooling.

Note: Requirements

– Clean & Dry N_2

→ Otherwise, irreversible results on Aerogel transmutation characteristics.

Note that we have ~15 p.e., which we do not like to lose at all.

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From this page, Data Sheet.

Data sheet No.	Item	Detail
[1]	Silica Aerogel	SP-12 (Matsushita)
[2]	Reflector	DRP reflector (Gore-Tex)
[3]	PMT holder	MC901-Nylon (Quadrant EPP)
[4]	Cable (HV)	SL-v2YC$_E$H (KERPEN)
[5]	Cable (Signal, PMT to Preamp)	RG174/U (Coleman)
[6]	Cable (Signal, Preamp to FEE)	UL2833 (Hitachi-densen)
[7]	Cable (LED)	1872A, LAN cable Category-5E (Belden)
[8]	Cable (LV for Preamp)	M39118 (CDT)

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[1] MSDS for AEROGEL

Material Safety Data Sheet

Company : Matsushita Electric Works, Ltd.
Address : 1048, Kadoma, Osaka 571-8686, Japan
Section : Coating Business Promotion Department
Telephone Number : 06-6906-2018, Japan
Facsimile Number : 06-6904-4457, Japan

【 Product Name 】 Silica Aerogel SP- 12

【 Characteristics 】
- Chemical nature : silicon dioxide (SiO_2 : 90%)
- Form : block
- Color : transparent
- Odor : none

【 Physical data 】

・Density	:	0.04	g/cm^3
・Boiling point	:	—	
・Vapor pressure	:	—	
・Viscosity	:	—	
・Solubility in water	:	insoluble	
・Flash point	:	—	
・Ignition point	:	—	
・Explosion limits	:	—	
・Thermal decomposition	:	—	
・Hazardous decomposition products	:	none	
・Hazardous reactions	:	—	

【 Measures in case of accidents and fires 】
- First aid: Wash affected skin with soap and water .
  Wash affected eyes thoroughly under running water with eyelid open .
- Extinguish media: Water spray, foam, dry powder
- After crush and spillage : Take up with a dust-binding medium and dispose of .

【 Protective measures, storage and handling 】
＊ in case of crushed pieces or powder
- Technical protective:
  When handling larger quantities without extraction plant, breathing and eye protection required
- Personal protective equipment:
  Avoid inhalation of dust

【 Information of toxicity 】

・Acute oral toxicity	: lethal dose ＞ 2,000 mg/kg	(tested in mice)
・Skin irritation	: non-irritant	(tested on rabbits)
・Eye irritation	: non-irritant	(tested on rabbits)

＊ The product is confirmed as non hazardous substance by the tests based on the OECD Guideline for Testing Chemicals (1987).

【 Information on ecological effects 】
- Eliminability: Because of its poor solubility in water, the product is virtually separated from water mechanically in biological effluent treatment plants .

【 Further information 】

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[2] MSDS for GORETEX (1/3)

JAPAN GORE-TEX INC.
Kochi 1102-4, Mitsu-cho, Mitsu-gun,
Okayama-ken, JAPAN
Division: EMS Project
Telephone No. +81-867-24-1211
Facsimile No. +81-867-24-1366
Issue Date:
MSDS NO. JGI03-028-00

MATERIAL SAFETY DATA SHEET

Product Name: DRP® Reflectors 0.5mmt

Identity Information

Uniform/Composite: Uniform
Ingredients : Polyethylene tetrafluoride (polytetrafluoroethylene ; PTFE) 100%
Chemical formula: - $(CF_2 - CF_2)_n$ -
LERMCS No.: 6-939
CAS No. 9002-84-0

Hazard/Toxicity

Class : N/A
Hazard : None at normal temperatures
Toxicity: None, because PTFE does not have physiological activity. However, toxic gases (HF, COF_2, CO, CF_2=CF_2, etc.) are released when heated to high temperature. Generally, obvious decomposition starts at 260 DegC or above, but the gas emission is very low at or below 315 DegC. Once the temperature reaches about 400 DegC, the quantity of gas decomposition increases, thus increasing the toxicity.

First Aid Procedures

Inhalation : If decomposition gas is inhaled, move individual to fresh air, and consult a physician.
Ingestion : If ingested in large quantity, consult a physician for treatment. The material is inactive foreign matter to the body.
Note to the physician : Inhalation of fume generated from decomposed PTFE leads to temporal symptoms similar to influenza, called "polymer fume fever". The symptoms include headache, articular pains, general discomfort, fever, cough, chilliness, palpitation, breast discomfort.

[2] MSDS for GORETEX (2/3)

Fire Fighting Procedures

Fire Fighting : The material may produce toxic gas as a result of thermal decomposition. Fire fighters should wear, in addition to standard fire fighting clothings, either gas mask (absorbing organic gas and acid gas) or Self-contained Breathing Apparatus.

Extinguishing Media: Use extinguishing media as appropriate for the surrounding fire. Material does not burn without external flame.

Handling and Storage

Handling : Decomposition gas may be inhaled by smoking a cigarette having the material attached onto. To avoid this, smoking should be prohibited in the area where the material is handled.

Storage : No special attention is required.

Protection from Exhibition

Facilities : Use local exhaust ventilation when heating to 315 DegC or above.

Protection from Inhalation : Not necessary in ordinary status. Use airline mask according to the Industrial Safety and Health Law when treated at 315 DegC or above.

Physical & Chemical Data

Appearance: white film

Solubility: Insoluble in water and in most solvents

Boiling Point: N/A

Melting Point: 327 DegC (Does not fluidize)

Specific Gravity: 0.40 – 0.90

pH: N/A

Fire and Explosion Data

Flash Point: None (nonflammable)

Stability: Stable under normal conditions. Decomposition starts extremely slowly at 260 DegC or above. The decomposition is accelerated when heated to 400 DegC or above.

Hazard from Decomposition: Decomposition product (temperature at which the production may be accelerated) Tetrafluoroethylene (430 DegC or above), hexafluoropropylene (440 DegC or above), perfluoroisobuthylene (475 DegC or above), carbonylfluoride (500 DegC or above)

[2] MSDS for GORETEX (3/3)

Health Hazard Data

Ingestion: Inactive when orally administered to rats.
Eye: Gives only physical stimulation.
Skin contact: No possibility of irritating human skin
Entry from skin: No possibility of absorption through human skin
Inhalation: Inhalation of fine particles is not harmful.

Environmental Data

Inactive. Does not influence unless burnt.

Waste Disposal Method:

Dispose of the waste as nonflammable waste, in accordance with applicable national/local regulations. Do not burn. Filling in the reclaimed land is preferable.

Transportation Information

Nothing in particular

Applicable regulations

Nothing in particular.

Others

For further information, please contact:

JAPAN GORE-TEX INC. EMS Project
Telephone: +81-867-24-1211

References:

1) *Guidelines for handling fluoric resin* from Japan Fluoropolymers Industry Association
2) *Recommended Standard for Occupational Health on Thermal Decomposition Products of Fluoric resins : National Institute for Occupational Safety and Health, USA* from Japan Fluoropolymers Industry Association

Note: This document is furnished based on the information and data available as of the issue date, without warranty, expressed or implied as to the data and evaluations included herein. The notes herein assume that the material is handled in ordinary way. If it is used in special process or for new application, safety measures appropriate for the new process and/or application should be implemented.

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[3] MSDS for PMT holder (MC901, (1/3))

SAFETY DATA SHEET

according to the EU directive 91/155/EEC and ISO 11014

Quadrant Engineering Plastic Products

1. Product and company identification

Commercial product name: NYLATRON® MC901

Company (manufacturer) : Quadrant EPP Belgium NV
I. P. Noord - R. Tavernierlaan 2
B - 8700 Tielt
Tel. : +32-51-42-35-11
Fax : +32-51-42-33-00

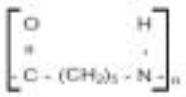
Emergency telephone number (local):

2. Composition/information on ingredients

This product is a chemical substance.

Chemical characterisation (eventually with synonyms): Heat stabilised cast polyamide 6 (heat stabilised cast nylon 6)

Chemical structure: PA 6G



CAS Nr. ('Chemical Abstract Service Registry Number'): PA 6G: 25038-54-4

3. Hazards identification

Most important hazards: No critical hazards for man and environment in case of normal storing, handling and usage.

Specific hazards: Not applicable

4. First-aid measures

Inhalation: In case the plastic burns and combustion gases are inhaled, immediately leave the room and get medical help.

Skin contact: In case molten material comes in contact with the skin, the skin needs to be rinsed abundantly with cold water. Do not try to remove the molten material. Get medical assistance for the removal of the tacky material and for the medical care of the burn.

5. Fire-fighting measures

Suitable extinguishing media: water, foam, dry chemical, CO2.

Extinguishing media which must not be used for safety reasons: None.

Special exposure hazards arising from the substance or preparation itself, combustion products or resulting gases:
See section 10.

Special protective equipment for fire-fighters:
Firemen should wear self-contained breathing apparatus and protective clothing to prevent contact with skin and/or eyes. If exposed to combustion fumes in a high concentration, bring the victim into fresh air. If molten material contacts skin, cool rapidely with cold water and obtain medical attention for removal of adhering material and treatment of the burn.

[3] MSDS for PMT holder (MC901, (2/3))

SAFETY DATA SHEET

according to the EU directive 91/155/EEC and ISO 11014

Quadrant Engineering Plastic Products

6. Accidental release measures

Personal precautions: Not applicable

Environmental precautions: See section 12 & 13

Methods for cleaning up: See section 13

7. Handling and storage

Handling:

Technical measures:	Not applicable
Precautions:	Not applicable
Safe handling advise:	During machining of the stock shapes, evacuate swarf to prevent slipping or tripping hazard.

Storage:

Technical measures:	Not applicable
Safe storage conditions:	Inert under normal storage conditions
Incompatible products:	Not applicable
Safe packaging materials:	Not applicable

8. Exposure controls / personal protection

Engineering measures to minimize worker exposure: None.

Personal protection:

Respiratory protection: None (except when the product burns - cfr. section 4 & 10)
Hand protection: Gloves in case of frequent contact with warm material.
Eye protection: Safety goggles during machining.

Industrial hygiene: Follow good standard industrial practice. No special precautions.

9. Physical and chemical properties

		According to
Appearance:	Form: Stock shapes (plate, rod and tube) Colour : Blue	
Odour:	No special odour	
Change in physical state:	Boiling point/boiling range: Not applicable Melting point/melting range: 220°C	
Flash point:	Not applicable	
Vapour pressure:	Not applicable	
Self ignition temperature:	> 400°C	ASTM D 1929
pH:	Not applicable	
Density (at 23°C):	1.150 g/cm³	ISO 1183
Solubility in water:	Negligible	
Thermal decomposition:	> 300°C	

[3] MSDS for PMT holder (MC901, (3/3))

SAFETY DATA SHEET

according to the EU directive 91/155/EEC and ISO 11014

Quadrant Engineering Plastic Products

10. Stability and reactivity

Stability:	In normal circumstances, the plastic and its chips are stable.
Conditions to avoid:	Temperatures above the melting point/melting range (see section 9)
Hazardous decomposition products:	The main products formed in case of overheating or combustion are apart from harmless H2 and CO2, mainly CO (depending on the amount of available environmental oxygen), NOx and traces of HCN.

11. Toxicological information

Acute toxicity: This material is not considered as being harmful to human health.
Local effects: Not applicable

12. Ecological information

This material does not harm the environment but is not biologically degradable.

13. Disposal considerations

Residual waste: When recycling is impossible, incineration or landfill. Disposal methods must conform to local or other government regulations. This product does not contain cadmium pigments or cadmium stabilizers.

Contaminated packaging: Not applicable

14. Transport information

International regulations: Not applicable

15. Regulatory information

Classification and labelling according to the relevant EU-directives is not required.

16. Other information

Read the product information brochures before using the Quadrant EPP materials.

Note:

All information supplied by or on behalf of Quadrant Engineering Plastic Products in relation to its products, whether in the nature of data, recommendations or otherwise, is supported by research and believed reliable, but Quadrant Engineering Plastic Products assumes no liability whatsoever in respect of application, processing or use made of the afore-mentioned information or products, or any consequence thereof. The buyer undertakes all liability in respect of the application, processing or use of the afore-mentioned information or product, whose quality and other properties he shall verify, or any consequence thereof. No liability whatsoever shall attach to Quadrant Engineering Plastic Products for any infringement of the rights owned or controlled by a third party in intellectual, industrial or other property by reason of the application, processing or use of the afore-mentioned information or products by the buyer.

Quadrant Engineering Plastic Products global leader in engineering plastics for machining

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[4] Data Sheet for HV cable (KERPEN SL-v2YCEH, (1/2))

KERPEN

HIGH VOLTAGE CABLE (multicore) — SL-v2YCeH

6 kV (DC) / 70°C

screened — *zero halogen, flame retardant*

Application

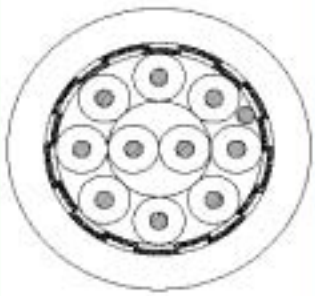
Used as fixed or flexible installed control cable for high voltage (dc) supply for electrical equipments and control units in research. For indoor and outdoor use in dry and wet locations. With reduced smoke emission, corrosiveness and toxicity of combustion gases acc. to CERN safety instruction IS 23.

Construction

- **Cores**
  Conductor ..... Tinned copper, flexible stranded, AWG26/7
  Insulation ..... Polyethylene
  Colour Code ..... Natural-coloured
- **Further Construction**
  Wrapping ..... Min. 1 layer of plastic tape, nom. 36µm
  Screen ..... Tinned copper wire braid, opt. coverage min. 80 %
  ..... over tinned copper drain wire, AWG26/7
  Outer Sheath ..... Zero halogen, flame retardant polymer
  Colour ..... Red
- **Cable Marking**
  Imprint ..... **KERPEN SL-V2YCEH SIZE 6kV(DC) ZERO HALOGEN yy W ww Length marking**

Manufacturer's identification thread

example for size: 20 x AWG 26/7
yy W ww is a five-character batch code for year and week



Technical Data

Flame retardancy:	IEC 60332-1	***Temperature range:***	-30°C up to +70°C *(during operation)*
Flame propagation:	IEC 60332-3-24 cat. C		-5°C up to +50°C *(during installation)*
Smoke density:	IEC 61034-1 and -2	***Min. bending radius:***	
Amount of halogen acid gas:	IEC 60754-1; 0%		6 x cable-Ø *(fixed installation)*
Degree of acidity of gases:	IEC 60754-2		10 x cable-Ø *(flexible installation)*
Outer sheath:			
Limiting Oxygen Index (LOI):	**min. 43%** (IEC 60332-3 ann. B)		
Temperature Index (TI):	**min. 260°C** (ASTM-D-2863)		

Abbreviations

SL-	high voltage cable
v	tinned copper conductor
2Y	insulation of PE
C	screen of copper wire braid
E	drain wire
H	outer sheath of LSZH

Test voltage

	Character	Unit	Values
Core/Core	nom.	kV (DC)	12
Core/Screen	nom.	kV (DC)	12

[4] Data Sheet for HV cable (KERPEN SL-v2YCEH, (2/2))

KERPEN

HIGH VOLTAGE CABLE (multicore) — **SL-v2YCEH**

6 kV (DC) / 70°C

screened — zero halogen, flame retardant

Geometrical and Electrical Data

Number of Cores	Conductor		Core	Cable				Kerpen Part No.
	Single-wire-Ø (nom.) mm	Conductor resistance at 20°C (max.) Ω/km	Core-Ø (approx.) mm	Screen-wire-Ø (nom.) mm	Sheath-thickness (nom.) mm	Overall Diameter (approx.) mm	Weight (approx.) kg/km	
Conductor Size AWG26/7								
10	0.16	147	1.3	0.15	1.5	9.1	95	
20	0.16	147	1.3	0.15	1.5	10.7	130	
23	0.16	147	1.3	0.15	1.5	11.3	155	
25	0.16	147	1.3	0.15	1.5	11.8	170	
30	0.16	147	1.3	0.15	1.5	12.6	185	
32	0.16	147	1.3	0.15	1.5	12.6	195	
34	0.16	147	1.3	0.15	1.5	13.0	205	
37	0.16	147	1.3	0.15	1.5	13.0	215	76130005
52	0.16	147	1.3	0.20	1.5	15.0	285	
56	0.16	147	1.3	0.20	1.5	15.4	310	76130001

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[5] Data Sheet for Signal Cable (PMT←→Preamp) (RG174/G, (1/1))

COLEMANCABLE®

Toll-Free: (800) 323-9355 Fax: (847) 689-1192

PRODUCT DATA SHEET

PART NUMBER: 991069-xx-08

DESCRIPTION: RG174/U COAXIAL CABLE WITH 26AWG 88% BRAID

RATING: UL RECOGNIZED COMPONENT AWM STYLE 1354

Construction Parameters:

		Wall (in)*	OD (in)*
Conductors:	26 AWG (7/.0063) Stranded Copper Clad Steel		0.019
Dielectric:	Solid Polyethylene color natural	0.021	0.060
Shielding:	88% Tinned Copper Braid		0.078
Jacket:	PVC	0.011	0.100

Electrical Properties:

		VALUE*
Impedance (ohms):		50
Capacitance (pF/ft):		30.8
Velocity of Propagation (%):		66
Attenuation (Max db/100 ft):	50 MHz	6.6
	100 MHz	8.8
	200 MHz	11.9
	500 MHz	17.5
	900 MHz	28.2
	1000 MHz	30.2

Cable Cross-section:

(NOT TO SCALE)

Miscellaneous Information:

Jacket Color:	Black
Jacket Print (White):	E96824-I RG 174/U AWM STYLE 1354
Flame Rating:	UL 1581 VW-1 Vertical Flame Test
Max. Temperature Rating:	60 ° C
Maximum Operating Volts:	30 V RMS MAX.
Approx. Weight (lb/1000 ft):	8

Company Name: _____

Customer Approval: _____ Date: _____

On special orders the customer will accept all factory lengths and ± 10% of total order requested.

The information presented here is, to the best of our knowledge, true and accurate. However, since conditions of use are beyond our control, all recommendations or suggestions are presented without guarantee or responsibility on our part. We reserve the right to revise and modify all constructions to conform with the latest Regulatory requirement. We disclaim all liability in connection with the use of information contained herein or otherwise. This specification is propriety intellectual property of COLEMAN CABLE. Any information contained herein shall not be disclosed to any party without written consent of COLEMAN CABLE.

Issued: 1/06/00

* = Nominal value

By: PEP

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[6] Data Sheet for Signal Cable (Preamp←→FEE) (Hitachi-UL2833, (1/5))


平成 8年10月18日
仕様書番号 SP28-40120

ケル 株式会社 殿

納 入 仕 様 書

UL認定50Ω九芯多芯ケーブル
[品名略号：UL2833 8×30AWG(7/0.102)]

受領印欄

日立電線株式會社

日高工場 信号電線設計部

承 認	審 査	作 成

1996 Oct.18th

Specification

Product ID :UL2833

Approval [Seal]

Qualification [Seal]

Documentation [Seal]

Hidaka factory

HITACHI Densen (electrical cable) Co. LTD. [Seal]

[6] Data Sheet for Signal Cable (Preamp←→FEE) (Hitachi-UL2833, (2/5))

1.adapt

This specification is created based on UL style Subject 758. This adapt to the cable (UL2833 : 60℃,30V) which used for electronic instulments.

Use : internal wiring in Class 2 circuit of electronic equipment.

2.structur specification

Look the table1,2 and fig1,2 about the cable structure and specification.

table 1

Lists		Specification
cable center wire (UL Style 1745)	Conductor	Stranded soft copper wire with tin plated
	Insulator	FEP(color : look fig2). It is covering equally as table2 thickness
	Shield	Wrapping soft copper wire with tin plated. Wire diameter :0.08mm
	Jacket	FEP(color: look table2). It is covering equally as table2 thickness.
Discrimination		Discriminate the cables by jacket and insulator color, refer to table2
Coaxial cables stranding		Strand some cables as fig2
Sheath		Vinyl It is covering equally as table2 thickne Thickness (min) : more than 0.33mm Thickness (max) : more than 0.38mm Color :gray (cord number : gray No.F)

[6] Data Sheet for Signal Cable (Preamp←→FEE) (Hitachi-UL2833, (3/5))

3.mark

Following is written continuous on the surface of cable with not be erased easily.

AWM E41447 STYLE2833 VW-1 HITACHI

or

AWM E41447 STYLE2833 VW-1 HITACHI-T

4.packing

According to length, products are packed in order not to be damaged on carriage.
A card which has following items is attached on each length. UL label is printed other side of that card.

(1) Style No.
(2) Typical voltage
(3) Typical temperature
(4) Producer
(5) Product date
(6) Size of conductor
(7) Sheath thickness
(8) Length
(9) Rot No.
(10) File No.
(11) Uses

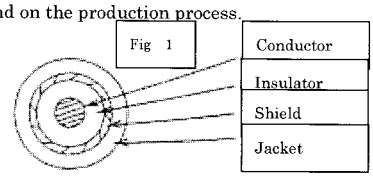
[6] Data Sheet for Signal Cable (Preamp←→FEE) (Hitachi-UL2833, (4/5))

Table 2

List		Unit	Specification				
Number of cables		-	10	13	15	16	17
Conductor	AWG size	-	30				
	Structure	raws/m	7/0.102				
	Diameter	mm	0.31				
Insulator	Thickness	mm	0.29				
	Diameter	mm	0.89				
Shield thickness(about)		mm	0.08				
Jacket	Thickness	mm	0.08				
	Diameter	mm	1.21				
Diameter of stranded		mm	4.8	5.2	5.6	5.7	6.0
Sheath	Thickness	mm	0.45				
	Diameter(max)	mm	5.7(6.2)	6.1(6.6)	6.5(7.0)	6.6(7.1)	6.9(7.4)
Resistor of conductor(20℃)		Ω/km	Less than 357				
Test voltage*1)		-	This bears AC500V for a minute.				
Resistor of Insulator*1) (20℃)		MΩ-km	More than 1,000				
Typical impedance (bet conductor - shield)		Ω	50±5 (at TDR)				
Delay time (bet conductor - shield)		nsec/m	Standard 4.8 (at TDR)				
Flamability		-	Pass UL VW-1 test				
Specific temperature		℃	60				
Specific voltage		V	30				
Standard length		m	150				
Packing			Bundle				
Weight		kg/km	55	69	79	82	87

*1) Specify between conductors or conductor and shield, however spark test is done between shield and ground on the production process.

Fig 1



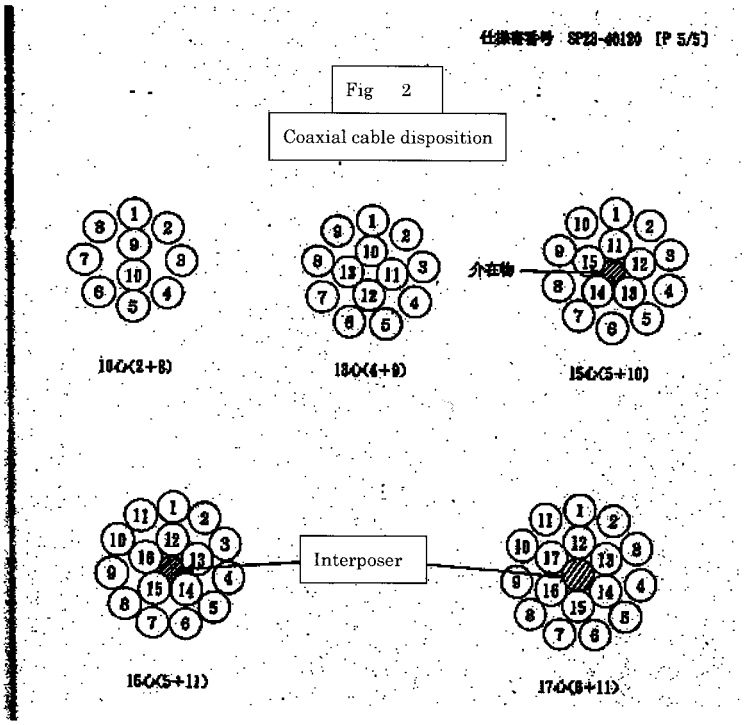
Cross section of cable

[6] Data Sheet for Signal Cable (Preamp←→FEE) (Hitachi-UL2833, (5/5))

仕様書番号 SP23-00120 [P 5/5]

Fig 2

Coaxial cable disposition



<Table of coaxial cable discriminaton>

Cable No	Insulator color	Jacket color	Cable No	Insulator color	Jacket color
1	Black	red	11	gray	red
2	Black	blue	12	gray	blue
3	Black	green	13	gray	green
4	Black	yellow	14	gray	yellow
5	black	gray	15	gray	gray
6	wite	red	16	blue	red
7	wite	blue	17	blue	blue
8	wite	green			
9	wite	yellow			
10	wite	gray			

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[7] Data Sheet for LED Cable (Belden1872A, (1/5))

Detailed Specifications & Technical Data

Belden

1872A Paired - MediaTwist® Enhanced Category 6

For more information please call
1-800-Belden1

See Put-ups and Colors

Color Code Chart : No. 8 for DataTwist Cables (Modified Western Electric).pdf

Description:

Premise Horizontal Cable, 4 Pair UTP, 350MHz Enhanced Category 6, Riser Rated, #23 Solid Bare Copper, Polyolefin Insulation, Bonded Pairs, PVC Jacket, Rip Cord, Sequential Marking at Two Foot Intervals

PHYSICAL CHARACTERISTICS:

CONDUCTOR:

Number of Pairs	4
Total Number of Conductors	8
AWG	23
Stranding	Solid
Conductor Diameter	.022 in.
Conductor Material	BC - Bare Copper

INSULATION:

Insulation Material	PO - Polyolefin
Nom. Insulation Wall Thickness	.009 in.
Insulation Diameter	.038 in.

PAIR:

Pair Color Code Chart :

Number	Color	Number	Color
1	White/Blue Stripe & Blue	3	White/Green Stripe & Green
2	White/Orange Stripe & Orange	4	White/Brown Stripe & Brown

OUTER SHIELD:

Outer Shield Material	Unshielded

OUTER JACKET:

Outer Jacket Material	PVC - Polyvinyl Chloride

OVERALL NOMINAL DIAMETER:

Overall Nominal Diameter	.165 x .165 in.

MECHANICAL CHARACTERISTICS:

Page 1 of 5

[7] Data Sheet for LED Cable (Belden1872A, (2/5))

Detailed Specifications & Technical Data

Belden

1872A Paired - MediaTwist® Enhanced Category 6

Operating Temperature Range	-20°C To +80°C
Bulk Cable Weight	29 lbs/1000 ft.
Max. Recommended Pulling Tension	45 lbs.
Min. Bend Radius (Install)	0.1 in.

APPLICABLE SPECIFICATIONS AND AGENCY COMPLIANCE:

APPLICABLE STANDARDS:

NEC/(UL) Specification	UL Subject 444
TIA/EIA Specification	TIA/EIA 568 B.2-1 Cat 6

FLAME TEST:

UL Flame Test	CMR, UL 1666 Riser
C(UL) Flame Test	CMR
CSA Flame Test	FT4

ELECTRICAL CHARACTERISTICS:

Nom. Mutual Capacitance @ 1 KHz	15.0 pF/ft
Maximum Capacitance Unbalance (pF/100 m)	49.2 pF/100 m
Nominal Velocity of Propagation	70 %
Maximum Delay (ns/100 m)	510 @ 100MHz ns/100 m
Maximum Delay Skew (ns/100m)	25 ns/100 m
Maximum Conductor DC Resistance @ 20 Deg. C	9 Ohms/100 m
Maximum DCR Unbalance @ 20 Deg. C	5 %
Max. Operating Voltage - UL	300 V RMS

ELECTRICAL CHARACTERISTICS - PREMISE:

Premise Cable Electricals Table 1 :

Page 2 of 5

[7] Data Sheet for LED Cable (Belden1872A, (3/5))

Detailed Specifications & Technical Data

Belden

1872A Paired - MediaTwist® Enhanced Category 6

Frequency (MHz)	Max. Attenuation (dB/100 m)	Min. NEXT (dB)	Min. PSNEXT (dB)	Min. ACR (dB)	Min. PSACR (dB)	Min. Return Loss (dB)	Min. Structural Return Loss (dB)
1	1.9	74.3	72.3	70	70	20.0	
4	3.7	65.3	63.3	59	59	23.0	
8	5.3	60.3	58.8	53	53	24.5	
10	5.9	59.3	57.3	51	51	25.0	
16	7.5	56.3	54.3	46	46	25.0	
20	8.4	54.8	52.8	44	44	25.0	
25	9.5	53.4	51.4	42	42	24.3	
31.25	10.6	51.9	49.9	39	39	23.6	
62.5	15.4	47.4	45.4	30	30	21.5	
100	19.8	44.3	42.3	25	25	21.0	
155	25.1	41.5	39.5	14	14	21.0	
200	29.0	39.9	37.9	10	10	21.0	
250	32.8	38.3	36.3	3	3	18.0	
300	35.2	37.2	34.2	0	0	18.0	
310	37.1	36.9	34.9			18.0	
350	39.8	36.2	34.2			17.0	
400	43.0	35.3	33.3			14.0	
500	49.0	33.8	31.8			14.0	

Premise Cable Electricals Table 2 :

Frequency (MHz)	Input (Unfitted) Impedance (Ohms)	Fitted Impedance (Ohms)	Min. ELFEXT (dB)	Min. PSELFEXT (dB)
1	100 ± 12	100 ± 15	67.8	64.8
4	100 ± 12	100 ± 15	55.7	52.7
8	100 ± 12	100 ± 15	49.7	46.7
10	100 ± 12	100 ± 15	47.8	44.8
16	100 ± 12	100 ± 8	43.7	40.7
20	100 ± 12	100 ± 8	41.7	38.7
25	100 ± 15	100 ± 8	39.8	36.8
31.25	100 ± 15	100 ± 8	37.9	34.9
62.5	100 ± 15	100 ± 8	31.8	28.8
100	100 ± 15	100 ± 8	27.8	24.8
155	100 ± 15	100 ± 8	23.9	20.9
200	100 ± 15	100 ± 8	21.7	18.7
250	100 ± 20	100 ± 8	19.8	16.8
300	100 ± 20	100 ± 8	18.2	15.2
310	100 ± 20	100 ± 8	17.9	14.9
350	100 ± 22	100 ± 8	16.9	13.9
400	100 ± 32	100 ± 8	15.7	12.7
500	100 ± 32	100 ± 8	13.8	10.8

NOTES:

Page 3 of 5

[7] Data Sheet for LED Cable (Belden1872A, (4/5))

Detailed Specifications & Technical Data

Belden

1872A Paired - MediaTwist® Enhanced Category 6

Notes

Applications: Gigabit Ethernet, 100BaseTX, 100BaseVG ANYLAN, 155ATM, 622ATM, NTSC/PAL Component or Composite Video, AES/EBU Digital Video, RS-422, Noisy Environments | US Patent #'s 5, 606, 151; 5, 734, 126; 5, 821, 467
**Values above 350 MHz are information only

PUT-UPS AND COLORS:

Item	Description	Put-Up (ft.)	Ship Weight (lbs.)	Jacket Color	Notes
1872A 0021000	4 PR #23 PP PVC	1000	37	RED	C
1872A 002A1000	4 PR #23 PP PVC	A1000	38	RED	
1872A 0031000	4 PR #23 PP PVC	1000	37	ORANGE	C
1872A 003A1000	4 PR #23 PP PVC	A1000	38	ORANGE	
1872A 0041000	4 PR #23 PP PVC	1000	37	YELLOW	C
1872A 004A1000	4 PR #23 PP PVC	A1000	38	YELLOW	
1872A 0051000	4 PR #23 PP PVC	1000	37	GREEN, DARK	C
1872A 005A1000	4 PR #23 PP PVC	A1000	38	GREEN, DARK	
1872A 0061000	4 PR #23 PP PVC	1000	37	BLUE, LIGHT	C
1872A 006A1000	4 PR #23 PP PVC	A1000	38	BLUE, LIGHT	
1872A 0071000	4 PR #23 PP PVC	1000	37	VIOLET	C
1872A 007A1000	4 PR #23 PP PVC	A1000	38	VIOLET	
1872A 0091000	4 PR #23 PP PVC	1000	37	WHITE	C
1872A 009A1000	4 PR #23 PP PVC	A1000	38	WHITE	
1872A 0101000	4 PR #23 PP PVC	1000	37	BLACK	C
1872A F6H1000	4 PR #23 PP PVC	1000	37	GRAY, DARK PEARL	C
1872A F6HA1000	4 PR #23 PP PVC	A1000	38	GRAY, DARK PEARL	
1872A X6G1000	4 PR #23 PP PVC	1000	37	GOLD X6G	C
1872A X6GA1000	4 PR #23 PP PVC	A1000	38	GOLD X6G	

C = CRATE REEL PUT-UP.

Revison Number: 1 Revison Date: 01-29-2003

Page 4 of 5

[7] Data Sheet for LED Cable (Belden1872A, (5/5))

Detailed Specifications & Technical Data

1872A Paired - MediaTwist® Enhanced Category 6

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[8] Data Sheet for LV cable (M39118, (1/1))

Manhattan/CDT CABLE DESIGN TECHNOLOGIES

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Control Cable

Power Limited Tray Cable - 2 and 3 Conductor - Foil Shield-Overall

VOLTAGE	TEMPERATURE	TYPE
300V	105°C	PLTC/ITC/CM
300V	105°C	PLTC/ITC/CL3

CONSTRUCTION:

Conductor:	Stranded tinned copper
Insulation:	Color coded PVC
Shield:	Aluminum/polyester foil
Drain Wire:	Stranded tinned copper
Jacket:	Chrome Gray PVC

SPECIFICATIONS:

IEEE
ICEA
UL Listed Subject 13, 2250
NEC Article 800
NEC Article 727
NEC Article 725
NEC Listed Type PLTC/ITC/CM
NEC Listed Type PLTC/ITC/CL3
IEEE 383 70,000 BTU
UL 1581
CEC/CSA - (FT-4)
Sunlight Resistant

DESCRIPTION:
For: Industrial automation and process control.

PART NO.	NO. OF COND.	NOM. JKT. THICKNESS INCHES	NOMINAL O.D. INCHES	APPROX. WT./M' LBS.	COLOR CODE
#22 AWG (7/30) INSULATION .016" NOMINAL TYPE PLTC/ITC/CM					
M39113	2	.038	.202	23	Blk, Red
M39114	3		.212	26	Blk, Red, Wht
#20 AWG (19/32) INSULATION .016" NOMINAL TYPE PLTC/ITC/CL3					
M39115	2	.038	.216	26	Blk, Red
M39116	3		.227	31	Blk, Red, Wht
#18 AWG (19/30) INSULATION .016" NOMINAL TYPE PLTC/ITC/CL3					
M39117	2	.038	.236	36	Blk, Red
M39118	3		.248	41	Blk, Red, Wht
#16 AWG (19/29) INSULATION .016" NOMINAL TYPE PLTC/ITC/CL3					
M39119	2	.038	.262	44	Blk, Red
M39120	3		.310	56	Blk, Red, Wht
#14 AWG (41/30) INSULATION .022" NOMINAL TYPE PLTC/ITC/CL3					
M39121	2	.043	.326	74	Blk, Red
M39122	3		.344	93	Blk, Red, Wht
#12 AWG (65/30) INSULATION .032" NOMINAL TYPE PLTC/ITC/CL3					
M39123	2	.053	.426	99	Blk, Red

REV 1/00

REGIONAL LOCATIONS
BOSTON • HOUSTON • PHILADELPHIA • LOS ANGELES

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